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Continuous positive airway pressure therapy effects on lipid and hepatic function test values

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CPAP Effects on Cardiovascular Outcomes: Lipids and Liver Function

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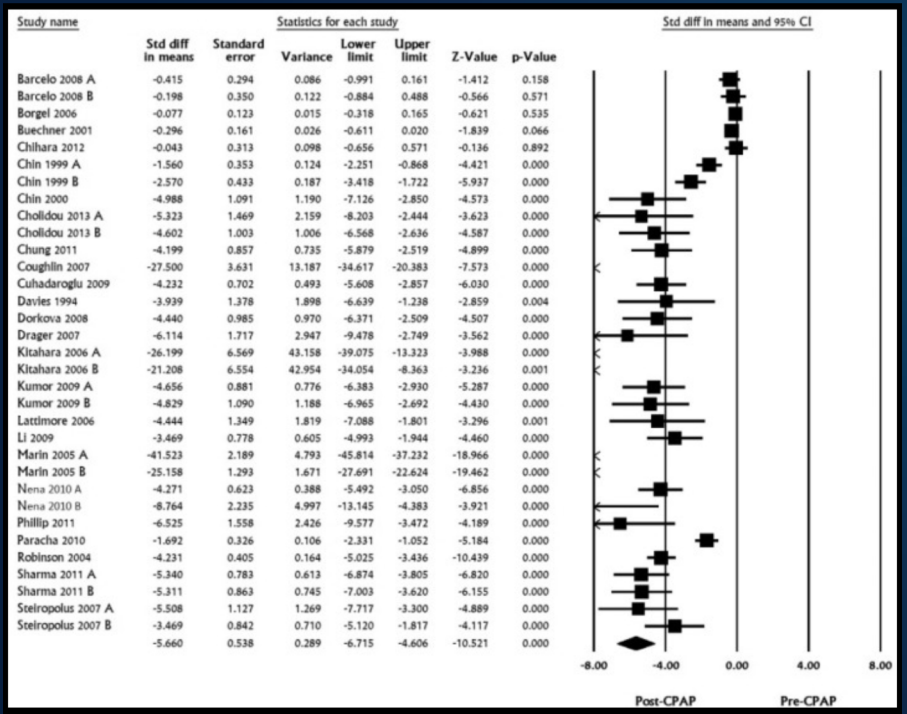
Introduction: Lipids

Continuous Positive Airway Pressure (CPAP) therapy has been shown to lower LDL-C, TC, TG, ALT, and AST, while increasing HDL-C. The degree of improvement has varied depending on CPAP therapy duration, compliance, and study design.



Study name	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Barcelo 2008 A	-0.415	0.294	0.086	-0.991	0.161	-1.412	0.158
Barcelo 2008 B	-0.198	0.350	0.122	-0.884	0.488	-0.566	0.571
Borgel 2006	-0.077	0.123	0.015	-0.318	0.165	-0.621	0.535
Buechner 2001	-0.296	0.161	0.026	-0.611	0.020	-1.839	0.066
Chihara 2012	-0.043	0.313	0.098	-0.656	0.571	-0.136	0.892
Chin 1999 A	-1.560	0.353	0.124	-2.251	-0.868	-4.421	0.000
Chin 1999 B	-2.570	0.433	0.187	-3.418	-1.722	-5.937	0.000
Chin 2000	-4.988	1.091	1.190	-7.126	-2.850	-4.573	0.000
Cholidou 2013 A	-5.323	1.469	2.159	-8.203	-2.444	-3.623	0.000
Cholidou 2013 B	-4.602	1.003	1.006	-6.568	-2.636	-4.587	0.000
Chung 2011	-4.199	0.857	0.735	-5.879	-2.519	-4.899	0.000
Coughlin 2007	-27.500	3.631	13.187	-34.617	-20.383	-7.573	0.000
Cuhadaroglu 2009	-4.232	0.702	0.493	-5.608	-2.857	-6.030	0.000
Davies 1994	-3.939	1.378	1.898	-6.639	-1.238	-2.859	0.004
Dorkova 2008	-4.440	0.985	0.970	-6.371	-2.509	-4.507	0.000
Drager 2007	-6.114	1.717	2.947	-9.478	-2.749	-3.562	0.000
Kitahara 2006 A	-26.199	6.569	43.158	-39.075	-13.323	-3.988	0.000
Kitahara 2006 B	-21.208	6.554	42.954	-34.054	-8.363	-3.236	0.001
Kumor 2009 A	-4.656	0.881	0.776	-6.383	-2.930	-5.287	0.000
Kumor 2009 B	-4.829	1.090	1.188	-6.965	-2.692	-4.430	0.000
Lattimore 2006	-4.444	1.349	1.819	-7.088	-1.801	-3.296	0.001
Li 2009	-3.469	0.778	0.605	-4.993	-1.944	-4.460	0.000
Marin 2005 A	-41.523	2.189	4.793	-45.814	-37.232	-18.966	0.000
Marin 2005 B	-25.158	1.293	1.671	-27.691	-22.624	-19.462	0.000
Nena 2010 A	-4.271	0.623	0.388	-5.492	-3.050	-6.856	0.000
Nena 2010 B	-8.764	2.235	4.997	-13.145	-4.383	-3.921	0.000
Phillip 2011	-6.525	1.558	2.426	-9.577	-3.472	-4.189	0.000
Paracha 2010	-1.692	0.326	0.106	-2.331	-1.052	-5.184	0.000
Robinson 2004	-4.231	0.405	0.164	-5.025	-3.436	-10.439	0.000
Sharma 2011 A	-5.340	0.783	0.613	-6.874	-3.805	-6.820	0.000
Sharma 2011 B	-5.311	0.863	0.745	-7.003	-3.620	-6.155	0.000
Steiropolus 2007 A	-5.508	1.127	1.269	-7.717	-3.300	-4.889	0.000
Steiropolus 2007 B	-3.469	0.842	0.710	-5.120	-1.817	-4.117	0.000
	-5.660	0.538	0.289	-6.715	-4.606	-10.521	0.000

Figure 1. Total cholesterol, standard difference in means, before treatment versus after CPAP treatment.

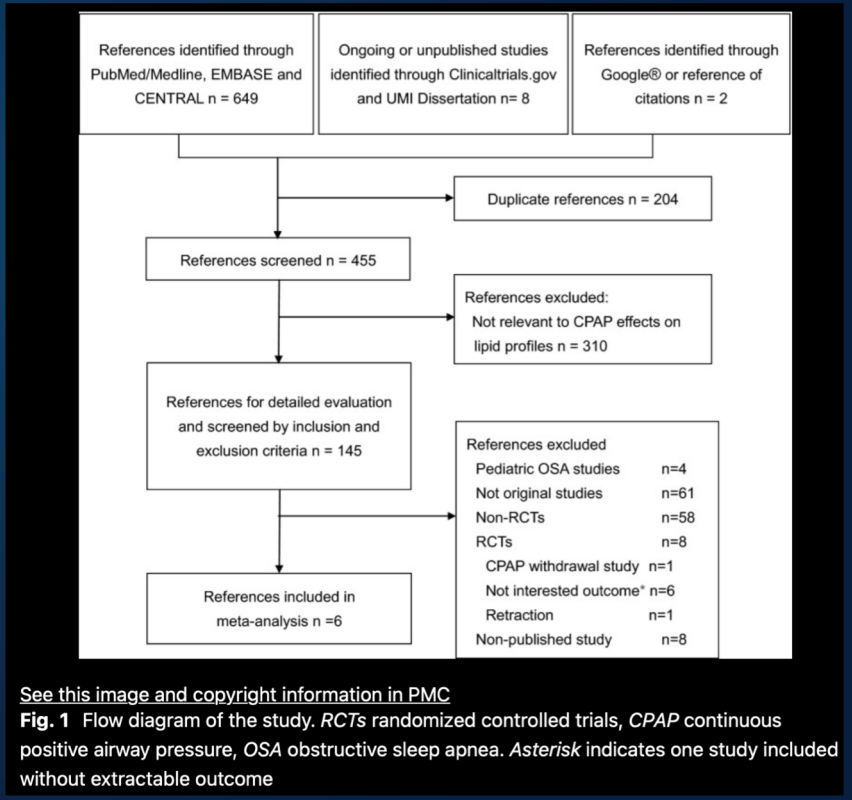


Fig. 1 Flow diagram of the study. *RCTs* randomized controlled trials, *CPAP* continuous positive airway pressure, *OSA* obstructive sleep apnea. *Asterisk* indicates one study included without extractable outcome

* Citations in powerpoint notes

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Introduction: Liver Enzymes

Fig. 1

From: Obstructive Sleep Apnea Is Associated with Fatty Liver and Abnormal Liver Enzymes: a Meta-analysis

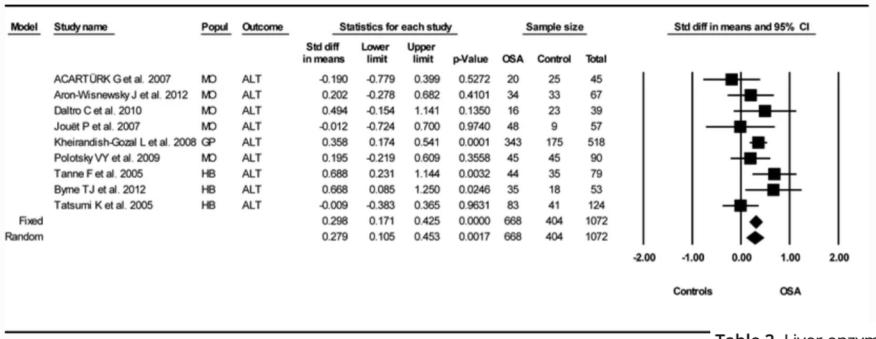

Table 2. Liver enzymes before and after CPAP

Study	Pre-CPAPSample size	Post-CPAPSample size	Pre-CPAP BMI	Post-CPAP BMI	Pre-CPAP ALT(U/l)	Post-CPAP ALT(U/l)	Pre-CPAP AST(U/l)	Post-CPAP AST(U/l)
Chin A 2003	40	40	31±4	31±4	66±60	62±51	39±28	34±24
Chin B 2003	34	34	30.1±4.4	29.2±4.1	66±75	40±36	37±25	26±14
Chin C 2003	34	26	NR	NR	66±75	36±25	37±25	23±9
Kohler 2009	44	44	35.6±7.1 (n=47)	NR	39.1±26.3	30.3±16.4	29.1±14.7	30.2±13.6
Shpirer 2010	6	6	34.8±5	35±5.2	35.1±12.6	24.9±7.8	23.7±5.4	19±2.2
Sivam 2012	27	27	31.3±3.8	31.6±3.7	41.1±19.9	39.8±16.2	26.6±8.1	25.8±6.7
Buttacavoli 2016	15	15	35.4±6.4	34.2±6.1	34.9±38.1	26.4±16.6	28.3±22.4	21.8±7.6

The specific aim of the following retrospective chart review study is to determine if there is significant improvement in lipid panel and liver function test variables in patients that use CPAP therapy.

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Objectives & Hypothesis

- **Research Question:** Does continuous positive airway pressure (CPAP) therapy improve lipid panels and liver function tests in patients with obstructive sleep apnea (OSA)?

- **Hypothesis:** Jefferson OSA patients (Sleep Center/ Family Medicine) who are adherent to CPAP therapy (defined as greater than 4 hours of use on average per night) will have lower LDL-C, TG, and TC, as well as increased HDL-C. Furthermore, AST and ALT enzymes will also be lower with consistent CPAP use.

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Approach & Results

- **Study Design:** retrospective chart review, goal 5000-10,000 charts; planned follow up prospective review
- **Population / study sample:** Jefferson Family Medicine Department & Sleep Center patients
- **Intervention:** CPAP therapy
- **Comparison group**: non-OSA patients, CPAP-noncompliant patients
- **Outcomes:** HDL-C, LDL-C, TC, TG, ALT, AST, and liver US pathology (cysts, abscess, steatosis, cirrhosis, etc).
- **Data source and collection:** EPIC patient charts; Office365 Excel doc
- My contribution: Many hours/months spent on lit review developing individual aim; teamwork creating and refining the database and chart review protocol

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Approach & Results: LFT's and Lipids

- **Analysis:** pilot 10 chart statistical analysis - SAS version 9.4 - 2 of 10 had lipid panels, 4 of 10 had liver function tests, 1 of 10 had negative hepatic ultrasound

PreHDLAvg	OnHDLAvg	OffHDLAvg	PreLDLAvg	OnLDLAvg	OffLDLAvg	PreTCAvg	OnTCAvg	OffTCAvg	PreTGAvg	OnTGAvg	OffTGAvg
	80			116			211			85	
47		47	50		50	110		110	51		51

PreALTAvg	OnALTAvg	OffALTAvg	PreASTAvg	OnASTAvg	OffASTAvg
.	39		.	32	
23	.	.	22	.	.
.	.	28	.	.	29
11		11	13		13

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Approach & Results: Other Interesting Results

- **Analysis:** pilot 10 chart statistical analysis - SAS version 9.4

- 3 Controls, 7 CPAP intervention, so far all results are non-significant due to small sample size

- ESS: decreased in sleepiness compared to controls
- Weight Change: slight increase in weight compared to controls
- NO correlation between BMI, blood pressure, heart rate, or blood glucose at baseline with AHI
- BP: paradoxical increase compared to controls (uncontrolled analysis due to very small sample size; could be due to medication use or other confounding factors)

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Conclusions

- Limited data prevented significant conclusions regarding CPAP therapeutic effect on lipid panels and LFTs
- Further investigation/increased sample size in the coming year may support current literature that CPAP therapy improves lipid and liver values

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Future Directions

- We have many MS1's who are currently signed up to ramp up data collection
- Will continue working on data collection and publication as project progresses
- Demonstrating that CPAP therapy could provide a non-pharmaceutical benefit to patients beyond its clinical indications for OSA

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